

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
BUREAU OF MINES

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Health and Safety  
District C

Welch, West Virginia  
August 4, 1960

Memorandum

To: W. R. Park, District Supervisor

From: J. L. Gilley, Mining Health and Safety Engineer

Subject: Report on Investigation of a Minor Coal-Mine Outburst, Glen Rogers No. 2 mine, Raleigh Wyoming Mining Company, Glen Rogers West Virginia, July 26, 1960.

A coal-mine outburst or bump in the subject mine at 9:15 a.m., July 25, 1960, caused injuries to a loading-machine operator and a brakeman. The 7 other employees on the section were not injured. After receiving first-aid treatment underground, the injured men were taken to the surface, examined and treated by a doctor, then taken to a hospital in Beckley, West Virginia. The brakeman received a compound fracture of the right ankle, a fracture of the left leg, abrasions and contusions; the loading-machine operator received abrasions and contusions and possibly other injuries.

This outburst is the second occurrence to result in a lost-time accident in this mine since 1957, and since that time, 656,000 tons of coal have been mined from pillars.

Investigation of the outburst was made jointly by Messers S. L. Snyder, district inspector, West Virginia Department of Mines, Paul Stroud, section foreman, and the writer on July 26, 1960. Following the outburst on July 26, production of coal in the section involved was stopped and on the following day, the equipment and materials were removed from the section.

On July 29, 1960, the Glen Rogers No. 2 mine ceased operations and work in removing face equipment and materials from the mine was started on August 1, 1960.

The Glen Rogers No. 2 mine is opened by 6 shafts ranging from 500 to 700 feet in depth; 2 of the shafts serve as air intakes and the others as return airways. All coal is mechanically loaded into mine cars and shuttle cars. The mine is operated in the low-volatile bituminous Beckley coal bed, which ranged from 48 to 92 inches in thickness in this area. Numerous faults and rolls have been encountered on this property, and the coal bed is undulating but dips about 2 percent northwest. Localized dispositional changes in the immediate roof were encountered in many areas of the mine. In some parts

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Files

of the mine the roof immediately overlying the coal bed was comprised of dark gray shales of varying degrees in hardness and ranged from a few inches to 10 feet or more in thickness overlain by a thick stratum of sandstone. In other parts of the mine, massive sandstone, ranging from 53 to 89 feet thick, as indicated by inspection of the logs of 4 boreholes on the property, either contacted the coal bed or was very near to it. The immediate roof in the area involved consisted of irregularly bedded sandstone that indicated fracture from stress. The immediate roof overlying the No. 3 pillar that bumped changed from sandstone to 22 inches of firm shale within the width of the pillar. The log of a borehole 600 feet from the scene of the bump indicated a stratum of sandstone, 53 feet 2 inches thick, near the coal and that there are other overlying strata of sandstone present that range up to 89 feet thick. The floor underlying the coal bed consists of soft dark shale in some areas of the mine and very hard, dense, sandy shale in other areas. The floor in the vicinity of the coal-mine bump is comprised of a very hard, dense, sandy shale that resists yielding (heaving); however, the floor material had heaved to some extent prior to the outburst in Nos. 3, 4, and 5 room roadways and along the 3 east parallel haulageway.

Systematic methods of roof support were in effect. The roof in section was supported with conventional timbers, and the roof in the other 3 sections was supported by roof bolts or roof bolts used in conjunction with conventional timbers. Where conventional timbering only was used, the plan required that crossbars be set not more than 6 feet apart and posts, on not more than 6-foot centers, be set in the gob areas. A cap piece, 2 by 8 by 16 inches, was required to be used on each gob post, and safety posts were to be kept at each working face during the entire coal-producing cycle.

Roof bolting was not being done in the section where the bump occurred, but roof bolts had been installed on the 3 east parallel haulageway in conjunction with crossbars.

The mine was developed by room-and-pillar method. Main entries were driven in groups of 6, cross entries in groups of 4 at intervals of 2,700 and 3,000 feet, and room entries in groups of 3 or more. Entries and rooms were driven 16 to 18 feet wide, entries were on 75-foot centers; rooms were on various centers ranging from 75 to 100 feet and varied from 250 to 300 feet in depth. Crosscuts were made at intervals of about 80 feet. The distance between crosscuts in the No. 3 room, 3 east parallel ranged from about 80 to 117 feet.

Extraction of pillars is accomplished by taking a single open-end lift on the back side of the pillar or by alternate open-end lifts, one next to the gob area on the inby side and then another lift from the outby side next to the gob area; however, due to roof falls or other circumstances, this method was not always followed. The recovery of chain pillars in 3 east parallel depended mostly upon roof conditions or the nature and extent of roof falls encountered.



Mining in the 3 east parallel section at the time of the outburst was nearing completion. In fact, inasmuch as only the 2 pillars involved in the outburst and Nos. 4 and 5 pillar remnants remained unmined, a decision was made by the superintendent on July 21, 1960, to permanently abandon the 3 east parallel section at the end of the shift on July 22, 1960. On July 21, a federal inspector, during his routine inspection of the mine, inspected the section and he was informed accordingly that the section was to be abandoned permanently on July 22. However, at the end of the shift on July 22, the mine officials decided to continue operating the section for a few more days because mine production was down. Furthermore, it was understood that when the section was depleted or was stopped some of the section employees would be terminated, and disposition made of the face equipment.

The outburst occurred while rock was being loaded with Jeffrey L-400 (track-mounted) loading machine into a mine car in a pillar pocket turned into the side of No. 2 room pillar from the No. 3 room-pillar roadway in the 3 east parallel section (See Sketch B). The pillar pocket (the first cut in the pillar) was turned 40 feet from the gob end of the No. 2 pillar on July 22. After the place was prepared and the cut of coal nearly cleaned up, a section of roof fell next to the face (between face and inby supports). Inasmuch as it was nearing the end of the shift, no other work was done in the place that day. During the idle week-end period, another section of roof fell near the fall of the No. 2 pillar pocket. The maximum thickness of the 2 section of rock was 20 inches and the length was 6 feet and the width was 14 feet. When the men arrived on the section Monday morning, July 25, the foreman had 2 men drill 4 holes and blast the fallen rock. After the rock was blasted and the place examined by the foreman, the loading machine was moved into the place and then started loading the rock. Three cars of rock were loaded, and loading of the fourth and final car (Which was coupled to the permissible-type battery-powered locomotive) was started when the adjacent No. 3 room pillar bumped.

The outburst occurred with sufficient disruptive force to expell coal from the rib of the pillar, starting at a point 25 feet from the outby end and terminating about 5 feet from the inby end of the pillar, or a distance of 55 feet along the pillar. Unfortunately, the brakeman, who was watching the rock being loaded, was opposite the point where the stress wave released with the greatest force, as indicated by the resultant cavity 4 to 6 inches in height between the coal and roof and 6 feet in length. The brakeman was thrown against the side of the mine car and the loading-machine operator, who was struck by the outrush of coal, was thrown against the chassis of the loading machine; both men were partially covered with coal. At the time of the outburst, there were 4 men, including the motorman, at the entrance to the No. 3 room, and a shot firer, who, only a few minutes previously, had been sprinkling water on the rock during loading operations, was 10 feet inby the loading-machine operator. The concussion staggered the employees at the entrance to the place, and the shot firer was knocked down, but fortunately being in the center of the place and out of direct line of the stress wave, escaped injury. The foreman was 300 feet from the scene of the outburst.



The barrier pillar, of which Nos. 2 and 3 room pillars were apart, was originally 600 feet in length and 300 feet in width. The rooms had been developed and the pillars extracted very successfully to the location, as indicated in Sketch A, when mining was stopped temporarily during January 1960 to permit mining of some chain pillars and part of a barrier pillar on the right side of 3 east parallel haulage entry. This delay, plus incomplete mining of several of the 3 east parallel chain pillars and part of the right barrier resulted in additional weight upon the unmined pillars, including those involved directly in the outburst.

During the early part of 1960, the writer visited the 3 east parallel section and discovered that mining of the left barrier pillars had been stopped. This situation was discussed with the mine foreman and with the superintendent. The writer explained that difficulty likely would result by not mining the few remaining pillars in the left barrier, and the fact that partial mining was to be followed in extracting some of the chain pillars and the right barrier pillar. On June 20, 1960, the author visited the 3 east parallel section, (his last visit to this section prior to investigation of the bump) and found that mining of the remaining pillars in the left barrier had resumed on June 15. During the visit on June 20, the writer explained to the section foreman that the delay in mining in that area, in addition to other factors, had resulted in the remaining pillars being definitely stressed, especially the Nos. 2 and 3 room pillars because of their comparatively large dimensions. The Nos. 2 and 3 room pillars, at the time of the bump, were approximately 55 feet in width and 110 and 80 feet, respectively, in length. The writer questioned the foreman as to how he planned to mine these 2 pillars and he replied that he planned to extract them in the identical manner being attempted when the bump occurred. The writer cautioned the foreman to "stay out from in front of these pillars and mine them strictly by taking open-end lifts across the inby ends (gob) until the pillars were reduced to about 40 feet in length". Also, it was suggested that "inducer shots" (blasting) be used in mining these pillars, especially while mining the first 2 or 3 cuts in each lift and continue until the pillars were reduced in dimensions, as suggested. Information concerning the condition and suggestions for mining the 2 pillars in the 3 east parallel section was given to the mine foreman in writing by the writer at the end of the shift on June 20. Furthermore, it was suggested that he check with and advise the section foreman, who incidentally was an extra foreman without experience in bumping conditions. The occurrence of the outburst several days later, however, is evident that sufficient precautionary measures were not taken in attempting to mine the pillars.

The cause of this minor coal-mine outburst resulted from a combination of conditions and factors mentioned above, and recommendations made during and following the investigation include:

1. Pillars should be recovered by the open-end lift method.
2. Adjacent pillars, where possible, should not be extracted from the same roadway.

3. A system of mining should be adopted that will produce the least number of critical areas during second or retreat mining.

4. The mining system should require that the coal pillars be developed as nearly uniform in size and in shape, as practicable so as to minimize overloading of individual pillars.

5. To assist the roof in caving, complete extraction should be striven for, and pillar remnants that tend to retard caving should not be left in the goaf. If it is not possible to recover a pillar remnant that is of such size as to delay caving, then its load-carrying capacity should be destroyed by blasting.

6. In pillar recovery in areas where massive sandstone roof is near or immediately over the coal and resists caving and where the floor is hard and resists yielding, every effort should be made to extract the coal pillars in a manner that will permit orderly distribution of induced mining stresses.

#### ACKNOWLEDGMENT

The cooperation of Mr. S. L. Snyder of the West Virginia Department of Mines, company officials and employees, and members of the United Mine Workers of America during this investigation is gratefully acknowledged.

Respectfully submitted,

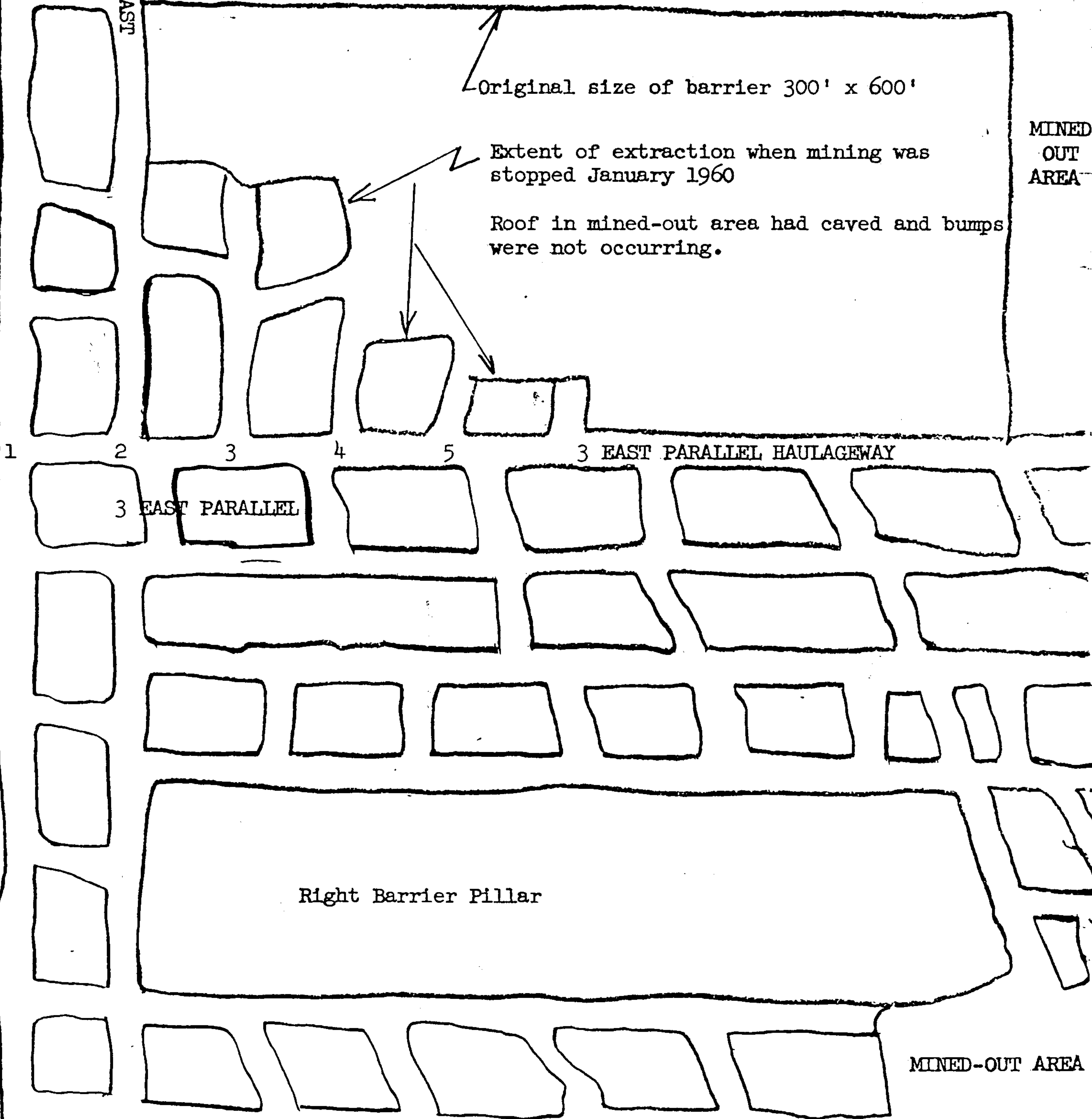
/s/ J. L. Gilley

J. L. Gilley  
Mining Health and Safety Engineer



SKETCH - A

MINED-OUT AREA



Plan showing extent of mining in  
3 East Parallel Barrier section  
January 1960

Glen Rogers No. 2 Mine  
Raleigh-Wyoming Mining Co.  
Glen Rogers, West Virginia

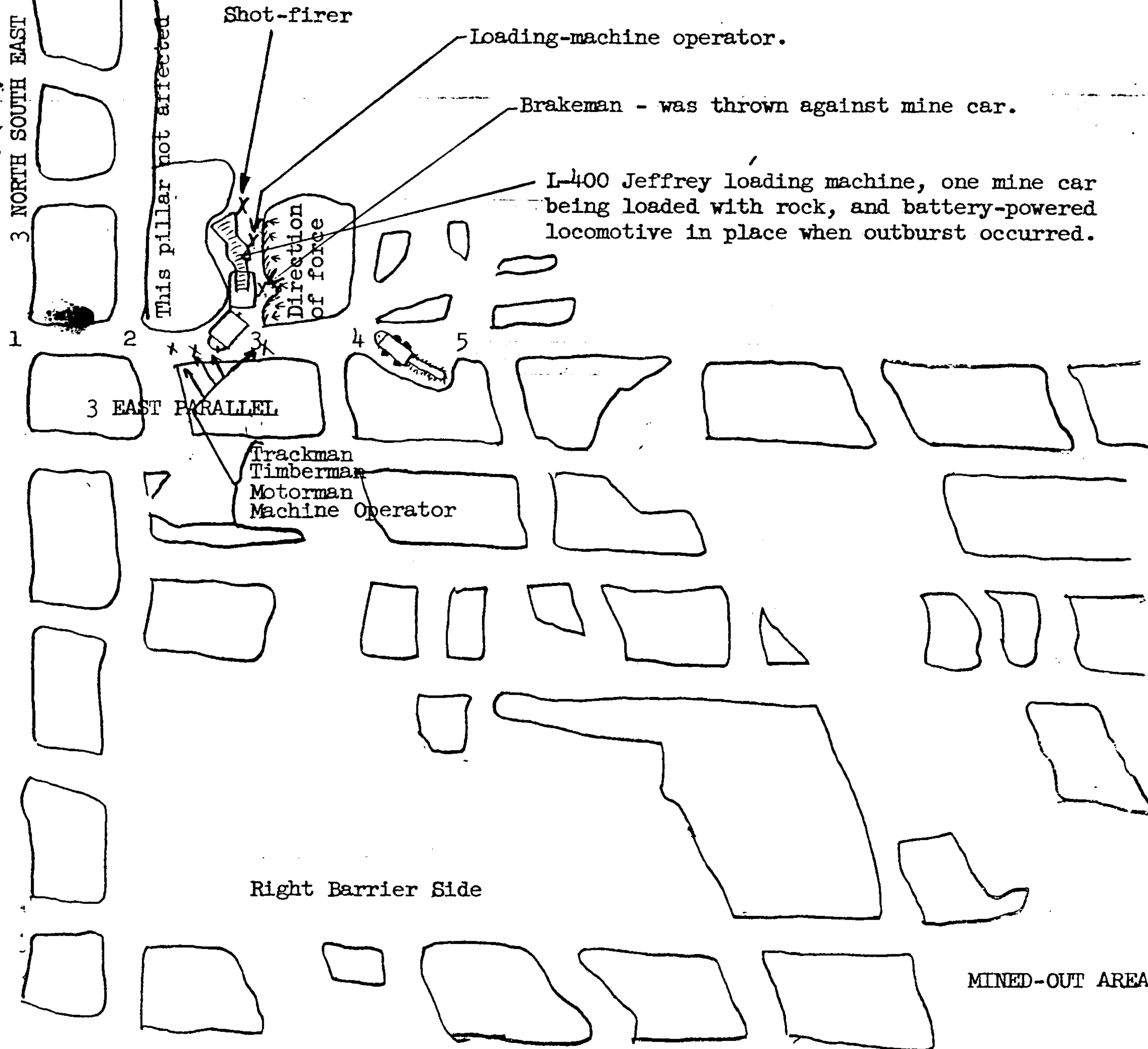
Scale = 1" = 100'

SKETCH - B

MINED-OUT AREA

MINED-OUT AREA

Plan indicates extent of extraction on day outburst occurred.



Plan showing scene of coal-mine outburst that occurred in No. 3 room pillar, 3 East Parallel Section - July 25, 1960.

Scale = 1" = 100'

Glen Rogers No. 2 Mine  
Raleigh-Wyoming Mining Company  
Glen Rogers, West Virginia